DEVELOPMENT OF SINGLE CYLINDER ENGINE TEST RIG FOR SMALL ENGINE DYNO

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Report submitted in partial fulfillment of the requirements

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project report and in my opinion this project is satisfactory in terms of scope and quality for the award of Diploma in Mechanical Engineering.

Signature :

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Position : LECTURER

Date :

STUDENT'S DECLARATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. The report has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature :

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ABSTRACT

This work is on the design and fabrication of a test rig structure that suite to the engine MODENAS Kriss 110cc. The objective of the report is to design and fabricate a test rig structure that suite to the engine MODENAS Kriss 110cc. This project also describes the review of products which are available around the world following to the title of the project. Design generation is showed and solid three dimensional structures modelling of the test rig structure that suite to the engine MODENAS Kriss 110cc was developed with computer aided design software. This report also explain the fabrication process that be needed for this project. Descriptions of material also show on this report. The problems encountered during completion of this project are also show in the report. An Improvement of the test rig structures that suite to the engine MODENAS Kriss 110cc needs for further application.

ABSTRAK

Laporan ini menunjukkan lukisan dan pembuatan struktur rangka ujian yang memuatkan enjin jenis MODENAS kriss 110cc. Objektif laporan ini adalah untuk lukisan dan pembuatan struktur rangka ujian yang memuatkan enjin jenis MODENAS kriss 110cc. Laporan ini juga menerangkan tentang produk-produk yang terdapat di serata dunia berdasarkan tajuk projek yang diberi. Konsep lukisan telah ditunjukkan dan permodelan struktur-struktur bongkah tiga dimensi untuk rangka ujian yang memuatkan enjin jenis MODENAS kriss 110cc yang telah dihasilkan menggunakan perisian lukisan bantuan komputer. Laporan ini juga menerangkan proses pembuatan yang diperlukan untuk projek ini. Penerangan mengenai bahan yang akan digunakan dalam projek juga diterapkan didalam laporan ini. Masalah yang dihadapi semasa menyiapkan projek ini juga terdapat di dalam laporan ini. Idea penambahbaikan untuk rangka ujian yang memuatkan enjin jenis MODENAS kriss 110cc juga disediakan untuk pembaharuan masa akan datang.

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LIST OF ABBREVIATIONS

Kg	Kilogram
Kgf.m	kilogram-force meter
Km/h	Kilometer per Hour
kW	kilo Watt
L	Liters
mm	millimeters
N.m	Newton meters
PS	Pound per Second
rpm	Revolution per minutes
SOCH	Single overhead camshaft

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

This project work on to design and fabricate a test rig structure for engine single cylinder that will test to the dyno engine. Engine single cylinder that been use for dyno test type MODENAS 110cc. The dynamometer engine is needed to calculate the torques in real time that delivered from the crankshaft single cylinder engine. So, the test rig for engine single cylinder must be rigidly and high stability when running. Overall, the project will meet acquire skills of design and fabrication.

1.2 PROBLEM STATEMENT

Engine MODENAS 110cc does not have any test rig to be mounted on the dyno engine. Therefore, a test rig must be designed and fabricated to sure that engine can run on the dyno. Furthermore, the test rig must be following the existing engine dyno dimension which is available in the Engine Performance Laboratory, University Malaysia Pahang.

1.3 OBJECTIVE

Objective for this project is to development of single cylinder engine test rig that suite to the 4 stroke engine model MODENAS 110cc for small engine dyno testing. Furthermore, this test rig stricture must be rigid and stable.

1.4 SCOPE

In project, scope project needed to specific range in the completion of a project. So, scope of this project is the test rig is suitable for engine model MODENAS Kriss 110cc only, it because every engine they had their specific dimension. Then, the design must fitting to the rail that existing on the Engine Performance Laboratory and the design that had fabricate were tested for fitting and static stability only to ensure the test rig do not break.

1.5 FLOW CHART

A flow chart, or flow diagram, is a graphical representation of a process or system that details the sequencing of steps required to create output. This flow chart was present steps or process of final year project that I will present in this semester. Figure 1.1 shows that process to complete my final year project.

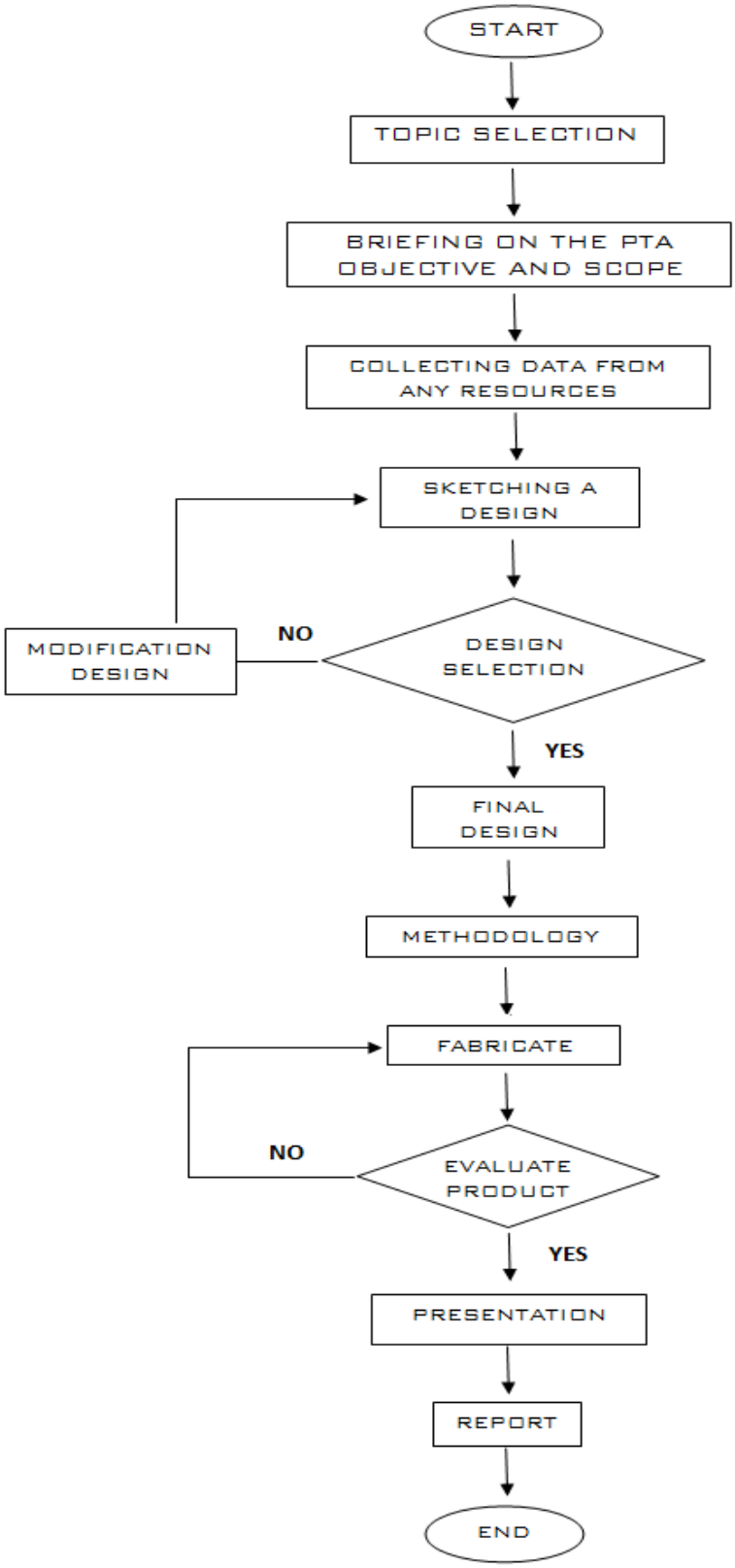

Figure 1.1: Flow Chart

The final year project starts with the title selection that been given. They had 31 title of project that had been state by coordinator final year project. Then, the topic that had selected will be brief about the problem, objective and scope by supervisor. From that data of literature review is need to make the objective are achieve. Data were collected from any research such as book, magazine, web site, or video. This step helps to create a design that suite to the product.

Regarding to the data that had collected, a design is needed for the fabricate process. The designs were crate by following the scope of project. It is to make sure the designs are following to the specification. After that, the designs that had created will continue to the selection design and the best design will be a final design and improvement to the design if needed. Then, it is ready to the fabricate session.

A final design is must complete with the dimensions to proceed to the fabrication. The fabrication process that involved is cutting, welding, bending, grinding, milling, and drilling.

Here come the testing and evaluation process. A product will be test to see if it full fills the requirement such as safety, ability and strength. During the testing, if a problem occurs, the process of fabrication a test rig structure will step back to the previous process. The reason to step back is to fix the error.

After all the parts had been joined together and no error, here comes the phase of result and discussion. In this part, how the multifunction will be inform. Beside, how to achieve objective and solve problem statement of the project will be discuss in this phase.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is a body of text that aims to review the critical points of current knowledge and or methodological approaches on a particular topic. Literature reviews are needed be get the information about the project that will operate. This review will give information about my project especially the product that had existed in the market and materials used on the fabrication. It is important to make sure my project become productive. Then, a design will create base on data that had been collected in literature review.

2.2 DYNAMOMETER

A dynamometer or "dyno" for short is a device for measuring force, moment of force (torque), or power. For example, the power produced by an engine or motor can be calculated by simultaneously measuring torque and rotational speed (RPM). For calculate the force and torque motoring or driving dynamometer is used. In my project, dynamometer is used to get the power and torque of engine model MODENAS Kriss 110 cc. Figure 2.1 shown how the engine and dynamometer are attached each other by coupling the crankshaft of engine and shaft on the dynamometer to measure the torque and velocity of engine.

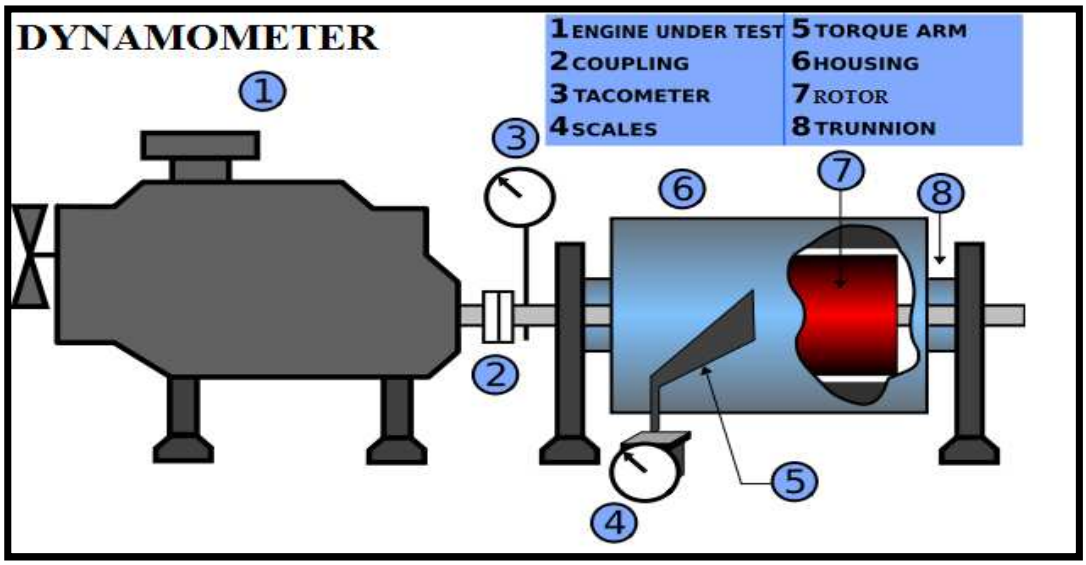

Figure 2.1: Dynamometer

Source: http://en.wikipedia.org

In semester 3 I have learn how to calculate velocity, torque, and power that lecture by (En. Azrul, 2009) in subject solid mechanic. To determined the engine speed and torque using the following equation:

$$P = \tau \cdot \omega$$

Or

$$P = F \cdot v$$

Where

P is the power in watts

τ is the torque in Newton meters

ω is the angular velocity in rotations per minutes

F is the force in Newton

v is the linear velocity in meters per minutes

Dynamometer that had in automotive laboratory is type Eddy Current. This dynamometer can detect power over 150 kW. Eddy-Current Dynamometer's theory is based on Eddy-Current (Fleming's law of right hand). The construction of eddy-current electro brake as shown in Figure 2.3 has a notched disc (rotor) which is driven by a prime mover (such as engine, etc.) and magnetic poles (stators) are located outside of it with a gap. The coil which excites the magnetic pole is wound in circumference direction. When a current runs through exciting coil, a magnetic flux loop is formed around the exciting coil through stators and a rotor. The rotation of rotor produces density difference, then eddy-current goes to stator. The electromagnetic force applies in opposite of the rotational direction by the product of this eddy-current and Vector of magnetic flux and it becomes brake (TOKYO METER CO., LTD, 2000).

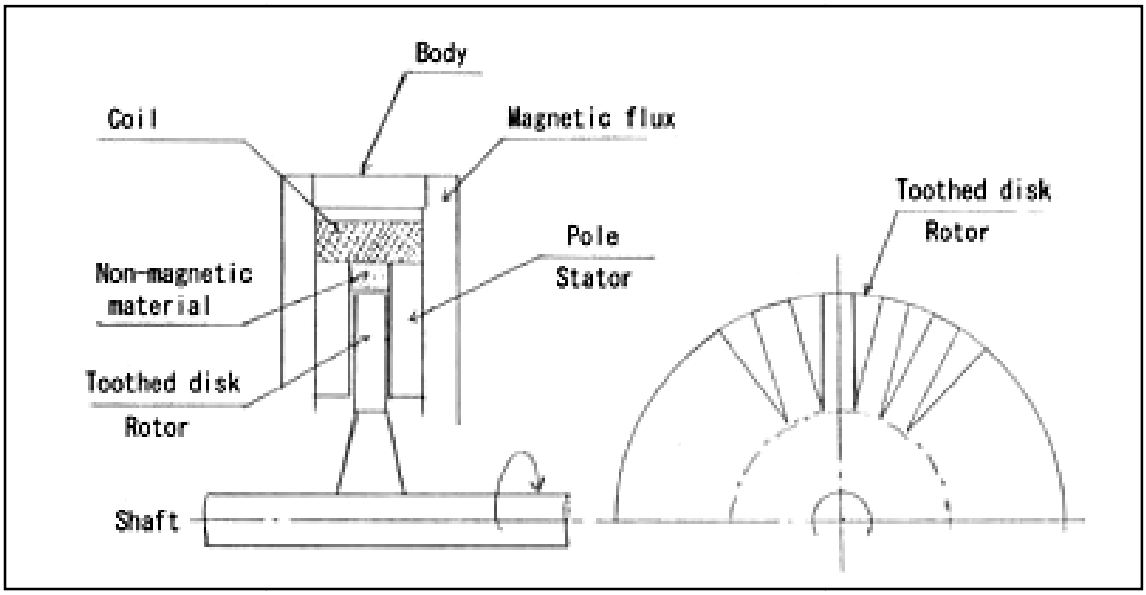

Figure 2.3: Contraction of Eddy Current Electro Brake

Source: http://www.tokyometer.co.jp

2.3 ENGINE

The engine that will operate on the dynamometer is model MODENAS Kriss 110cc. Table 2.1 shown the characteristics of the engine:

Table 2.1: Characteristic MODENAS Kriss 110 cc

KRISS 110 CC
Max power: 9.0 PS (6.6 kW) @ 8,500 rpm
Max torque: 9.3 N·m (0.95 kgf·m) @ 4,000 rpm
Engine type: SOHC 2-valve 4-stroke single-cylinder, air-cooled
Displacement: 111 cc
Bore x stroke: 53 x 50.6 mm
Compression ratio: 9.0:1
Fuel tank capacity: 4.3 L
Dry weight: About 100 kg
Transmission: 4 speed with automatic centrifugal clutch
Max speed: about 140 km/h

Figure 2.3 show the engine that existing at the laboratory. I had measure the dimension of the engine and get the area of engine are arrange 300mm x 440mm x 200mm.

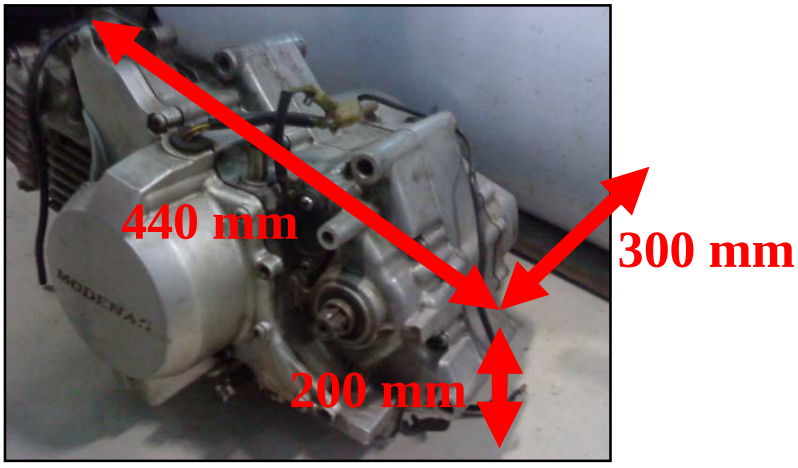

Figure 2.2: Engine Kriss 110 cc

2.4 TEST RIG

The test rig structure is the main structure for hang up the engine that will test on the dyno engine. The test rig structure was design base on the dimension dynamometer used such as height, and length. There are many of test structure can be design, because it base on the type of engine that used. A test rig that will fabricate must be static and rigidly for static stability of engine maintain when running.

2.4.1 Motorcycle Engine Test Rig

Figure 2.4 shown that test rig was made by Dr. Gitano Horizon (University Science Malaysia). This design was aim to testing at small engine dynamometer.

The material that been use to fabricate this test rig by using mild steel angle, mild steel hollow, nat and bold.

Figure 2.4: Motorcycle Engine Test Rig

Resource: www.skyshorz.com

2.4.2 Four Stroke Single Cylinder

Figure 2.5 shown that test rig single cylinder, 4 stroke diesel engine was fabricate by Techno Lab Equipments Company. This company had made many products on the engine including this one. The material that been use to fabricate this test rig by using mild steel angle and it is joining by welding method. The design was fixing and there are no adjustments.

Figure 2.5: Vcr Diesel Engine Test Rig

Resource: www.technolab.co.in

2.4.3 Fz Motorcycle Test Rig

This product was design and fabricate by engineer in Figure 2.6, this product had been test at Universiti Malaysia Pahang (UMP) for dynamometer test and it is located in Engine Performance Laboratory, UMP. There are so many materials used on fabricating this design but it is effective design and looks stable.